

REMARKS

Claims 1-49 are pending. Claims 1, 3, 5, 9, 13, 17, 19, and 25-27 have been amended. New claims 48 and 49 have been added. No new matter has been introduced. Reexamination and reconsideration of this application are respectfully requested.

In the January 16, 2003 Office Action, the Examiner objected to claims 3, 13, and 19 as depending from rejected base claims, but stated that they would be allowable if rewritten in independent form, incorporating all limitations of their respective base claims. Applicants have rewritten claims 3, 13, and 19 in independent form, per the Examiner's request, and respectfully submit that claims 3, 13, and 19, each as amended, are in condition for allowance.

The Examiner also rejected claims 1, 2, 4-12, 14-18, and 20-46 in the Office Action. The Examiner rejected claims 1, 2, 5-12, 15-18, 20-21, and 23-46 under 35 U.S.C. §103(a) as being obvious over U.S. Patent No. 5,504,270 to Sethares, in view of U.S. Patent No. 5,536,902 to Serra. Claims 4, 14, and 22 were rejected under 35 U.S.C. §103(a) as being obvious over Sethares in view of Serra, and further in view of the Examiner's Official Notice. These rejections are respectfully traversed.

Embodiments of the present invention are directed to an apparatus for converting an input voice signal into an output voice signal according to a reference voice signal. Extracting means extract only deterministic components from the input voice signal. The deterministic components including a plurality of sinusoidal wave components, and the input voice signal includes the deterministic components and residual components. Separating means separate the sinusoidal wave components

into frequency value coordinates and amplitude value coordinates. Memory means memorize reference pitch information representative of a pitch of the reference voice signal, and reference amplitude information representative of amplitudes of the sinusoidal wave components contained in the reference voice signal.

A first modulating means modulates the frequency value coordinates of the sinusoidal wave components of the input voice signal according to the reference pitch information retrieved from the memory means, to generate modulated frequency value coordinates. A second modulating means modulates the amplitude value coordinates of the sinusoidal wave components of the input voice signal according to the reference amplitude information retrieved from the memory means. A combining means combines the modulated frequency value coordinates and the modulated amplitude value coordinates to synthesize sinusoidal wave components of the output voice signal having an output pitch and an output timbre different from an input pitch and an input timbre, of the input voice signal, and influenced by a reference pitch and a reference timbre, of the reference voice signal. A mixing means mixes the synthesized sinusoidal wave components having the modulated frequency value coordinates to synthesize the output voice signal having a pitch different from that of the input voice signal and influenced by that of the reference voice signal.

In the January 16, 2003 Office Action, the Examiner rejected claims 1, 2, 5-12, 15-18, 20-21, and 23-46 under 35 U.S.C. §103(a) as being obvious over Sethares, in view of Serra. Claims 4, 14, and 22 were rejected under 35 U.S.C. §103(a) as being obvious over Sethares in view of Serra, and further in view of the Examiner's Official Notice. The Examiner stated that Sethares discloses a method and apparatus for

dissonance modification to audio signal, the method including passing a vocal input “to an analyzer to produce a spectrum of input partials in the form of frequency and amplitude domain, which reads on ‘extracting deterministic components from the input voice signal, the deterministic components including a plurality of sinusoidal wave components’, since frequency and amplitude are forms of sinusoidal wave components.” The Examiner noted that Sethares does not teach extracting only the deterministic components, but stated that Serra teaches “a method and apparatus for analyzing and synthesizing a sound by extracting and controlling a sound parameter and implements extraction of only deterministic components (col. 10, lines 3-29), for the purpose of generating a synthetic waveform of the deterministic component and then reanalyze and reextract the deterministic component, which is then subtracted from the magnitude spectra.” The Examiner further stated that it would have been obvious to a person of ordinary skill in the art at the time of the invention to combine the teachings of Sethares and Serra in the direction of claims 1, 2, 5-12, 15-18, 20-21, and 23-46.

The Examiner also rejected claims 4, 14, and 22 under 35 U.S.C. §103(a) as being obvious over Sethares, in view of Serra, and further in view of Official Notice. The Examiner stated that the combination of Sethares and Serra teaches all of the limitations of claims 4, 14, and 22 except for a switch means for outputting an original of the input voice signal in situations in which a pitch is not detected from the input signal. However, the Examiner took Official Notice that implementation of a switching mechanism to output an original signal when an input signal cannot be analyzed was well known in the art, and would have been obvious to combine with the teaching of Sethares and Serra to render claims 4, 14, and 22 obvious under 35 U.S.C. §103(a).

Independent claim 1, as amended, recites (with emphasis added):

1. An apparatus for converting an input voice signal into an output voice signal according to a reference voice signal, the apparatus comprising:
 - extracting means for extracting only deterministic components from the input voice signal, the deterministic components including a plurality of sinusoidal wave components, wherein the input voice signal includes the deterministic components and residual components;
 - separating means for separating the sinusoidal wave components into frequency value coordinates and amplitude value coordinates;**
 - memory means for memorizing reference pitch information representative of a pitch of the reference voice signal, and reference amplitude information representative of amplitudes of the sinusoidal wave components contained in the reference voice signal;**
 - first modulating means for modulating the frequency value coordinates of the sinusoidal wave components of the input voice signal according to the reference pitch information retrieved from the memory means, to generate modulated frequency value coordinates;
 - second modulating means for modulating the amplitude value coordinates of the sinusoidal wave components of the input voice signal according to the reference amplitude information retrieved from the memory means;**
 - combining means for combining the modulated frequency value coordinates and the modulated amplitude value coordinates to synthesize sinusoidal wave components of the output voice signal having an output pitch and an output timbre different from an input pitch and an input timbre, of the input voice signal, and influenced by a reference pitch and a reference timbre, of the reference voice signal; and**
 - mixing means for mixing the synthesized sinusoidal wave components having the modulated frequency value coordinates to synthesize the output voice signal having a pitch different from that of the input voice signal and influenced by that of the reference voice signal.

Sethares teaches a method for receiving an electronic audio input signal having at least one partial, or overtone, evaluating the dissonance of the input signal relative to a set of reference partials, and for producing an output signal having a larger or smaller dissonance than the input signal. (Col. 2, lines 12-17.) Sethares discloses using a "real time analyzer to calculate the spectrum of partials of [a] signal using FFT". (Col. 5, lines 25-28.) The input signal can then be altered by shifting "one or more of the input partials so that they have more desirable dissonance characteristics." (Col. 7, lines 13-16.) Sethares also discloses, in FIG. 4B, passing an analog input signal

through a series of bandpass filters 18 having differing pass-through frequencies, into a microprocessor 20 which carries out a dissonance reduction calculation, through oscillators to produce the output partial, and into an accumulator 24, which produces an output signal. [Col. 9, line 57 – col. 10, line 5.]

Serra teaches a method and apparatus for analyzing and synthesizing a sound by extracting and controlling a sound parameter such as a formant characteristic, a vibrato or tremolo characteristic, a spectral tilt characteristic, a pitch, or a specific waveform segment by detecting a vibrato-like low-frequency variation from analysis data.

However, neither Sethares nor Serra, alone or in combination with each other and/or the Examiner's Official Notice that implementation of a switching mechanism to output an original signal when an input signal cannot be analyzed is well known in the art, disclose, teach or suggest use of (a) separating means for separating the sinusoidal wave components into frequency value coordinates and amplitude value coordinates; (b) memory means for memorizing reference amplitude information representative of amplitudes of the sinusoidal wave components contained in the reference voice signal; (c) second modulating means for modulating the amplitude value coordinates of the sinusoidal wave components of the input voice signal according to the reference amplitude information retrieved from the memory means; and (d) combining means for combining the modulated frequency value coordinates and the modulated amplitude value coordinates to synthesize sinusoidal wave components of the output voice signal having an output pitch and an output timbre different from an input pitch and an input timbre, of the input voice signal, and

influenced by a reference pitch and a reference timbre, of the reference voice signal.

Thus, applicants submit that independent claim 1, as amended, distinguishes over Sethares and Serra, alone or in combination with the Examiner's Official Notice. Claims 2, 4-8, 30, and 36-37 all depend, directly, or indirectly from independent claim 1, as amended, and therefore also distinguish over Sethares and Serra, alone or in combination with the Examiner's Official Notice for the same reasons as those set forth above with respect to independent claim 1, as amended. Independent claims 17, 25, and 27 each contain limitations similar to those of independent claim 1, as amended, and therefore also distinguish over Sethares and Serra, alone or in combination with the Examiner's Official Notice for reasons similar to those set forth above with respect to independent claim 1, as amended. Claims 18-24, 28, 32, and 40-41 all depend, directly or indirectly, from independent claim 17, as amended, and therefore also distinguish over Sethares and Serra, alone or in combination with the Examiner's Official Notice for the same reasons as those set forth above with respect to independent claim 17, as amended. Claims 33 and 42-43 directly depend from independent claim 25, as amended, and therefore also distinguish over Sethares and Serra, alone or in combination with the Examiner's Official Notice for the same reasons as those set forth above with respect to independent claim 25, as amended. Claims 29, 35, and 46-47 directly depend from independent claim 27, as amended, and therefore also distinguish over Sethares and Serra, alone or in combination with the Examiner's Official Notice for the same reasons as those set forth above with respect to independent claim 25, as amended.

Independent claims 9 recites as follows (with emphasis added):

9. An apparatus for converting an input voice signal into an output voice signal according to a reference voice signal, the apparatus comprising:

- extracting means for extracting only deterministic components from the input voice signal, the deterministic components including a plurality of sinusoidal wave components, wherein the input voice signal includes the deterministic components and residual components;
- memory means for memorizing, as memorized amplitude value coordinates, reference amplitude information representative of amplitudes of the sinusoidal wave components contained in the reference voice signal;
- modulating means** for modulating the amplitude value coordinates of the sinusoidal wave components of the input voice signal extracted from the input voice signal according to the reference amplitude information retrieved from the memory means; and
- mixing means for mixing the plurality of the sinusoidal wave components having the modulated amplitude value coordinates to synthesize the output voice signal having a timbre different from that of the input voice signal and influenced by that of the reference voice signal,

wherein the modulating means comprises

- normalizing means** for normalizing the amplitude value coordinates of the sinusoidal wave components of the input voice signal by a mean amplitude of the input voice signal, to generate normalized amplitude value coordinates,
- a second mixing means for mixing the normalized amplitude value coordinates of the input voice signal and the memorized amplitude value coordinates of the reference voice signal with one another by a predetermined ratio to produce mixed amplitude value coordinates, and
- multiplying means** for multiplying the normalized amplitude value coordinates of the sinusoidal wave components of the input voice signal with the mean amplitude of the input voice signal.

Neither Sethares nor Serra, alone or in combination with each other and/or the Examiner's Official Notice that implementation of a switching mechanism to output an original signal when an input signal cannot be analyzed is well known in the art, disclose, teach or suggest use of a modulating means comprising (a) normalizing means for normalizing the amplitude value coordinates of the sinusoidal wave components of the input voice signal by a mean amplitude of the input voice signal, to generate normalized amplitude value coordinates, (b) a second mixing means for mixing the normalized amplitude value coordinates of the input voice signal and the memorized amplitude value coordinates of the reference voice signal with one another

by a predetermined ratio to produce mixed amplitude value coordinates, and (c) multiplying means for multiplying the normalized amplitude value coordinates of the sinusoidal wave components of the input voice signal with the mean amplitude of the input voice signal.

Thus, applicants submit that independent claim 9, as amended, distinguishes over Sethares and Serra, alone or in combination with the Examiner's Official Notice. Claims 10-12, 14-16, 31, and 38-39 all depend, directly or indirectly, from independent claim 9, as amended, and therefore also distinguish over Sethares and Serra, alone or in combination with the Examiner's Official Notice for the same reasons as those set forth above with respect to independent claim 9, as amended.

Independent claim 26 contains limitations similar to those of independent claim 9, as amended, and therefore also distinguishes over Sethares and Serra, alone or in combination with the Examiner's Official Notice for reasons similar to those set forth above with respect to independent claim 9, as amended. Claims 34 and 44-45 directly depend from independent claim 26, as amended, and therefore also distinguish over Sethares and Serra, alone or in combination with the Examiner's Official Notice for the same reasons as those set forth above with respect to independent claim 26, as amended.

Therefore, it is respectfully submitted that the rejection of claims 1, 2, 4-12, 14-18, and 20-46 under 35 U.S.C. §103(a) should be withdrawn.

Moreover, new claims 48 and 49 also distinguish over Sethares and Serra, alone or in combination with the Examiner's Official Notice. New claim 48 recites (with emphasis added):

48. (New) An apparatus for converting an input voice signal into an output voice signal according to a reference voice signal, the apparatus comprising:

extracting means for extracting only deterministic components from the input voice signal, the deterministic components including a plurality of sinusoidal wave components, wherein the input voice signal includes the deterministic components and residual components;

memory means for memorizing reference pitch information representative of a pitch of the reference voice signal;

modulating means for modulating frequency value coordinates of the sinusoidal wave components of the input voice signal according to the reference pitch information retrieved from the memory means; and

mixing means for mixing the plurality of the sinusoidal wave components having the modulated frequency value coordinates to synthesize the output voice signal having a pitch different from that of the input voice signal and influenced by that of the reference voice signal,

wherein the modulating means comprises

a second mixing means for mixing a reference pitch of the reference voice signal and an input pitch of the input voice signal with each other by a predetermined ratio to output a mixed pitch value,

normalizing means for normalizing the frequency value coordinates of the sinusoidal wave components by the input pitch of the input voice signal, and

multiplying means for multiplying the normalized frequency value coordinates of the sinusoidal wave components of the sinusoidal wave components by the mixed pitch value.

Neither Sethares nor Serra, alone or in combination with each other and/or the Examiner's Official Notice that implementation of a switching mechanism to output an original signal when an input signal cannot be analyzed is well known in the art, disclose, teach or suggest such modulating means comprising (a) a second mixing means for mixing a reference pitch of the reference voice signal and an input pitch of the input voice signal with each other by a predetermined ratio to output a mixed pitch value, (b) normalizing means for normalizing the frequency value coordinates of the sinusoidal wave components by the input pitch of the input voice signal, and (c) multiplying means for multiplying the normalized frequency value coordinates of the sinusoidal wave components of the sinusoidal wave components by the mixed pitch value. Thus, applicants submit that new independent claim 48 distinguishes over

Sethares and Serra, alone or in combination with the Examiner's Official Notice.

New claim 49 recites (with emphasis added):

49. An apparatus for converting an input voice signal according to a reference voice signal, the apparatus comprising:
extracting means for extracting only deterministic components from the input voice signal, the deterministic components including a plurality of sinusoidal wave components, wherein the input voice signal includes the deterministic components and residual components;
memory means for memorizing reference pitch information representative of a pitch of the reference voice signal;
modulating means for modulating frequency value coordinates of the sinusoidal wave components of the input voice signal according to the reference pitch information retrieved from the memory means;
mixing means for mixing the plurality of the sinusoidal wave components having the modulated frequency value coordinates to synthesize the output voice signal having a pitch different from that of the input voice signal and influenced by that of the reference voice signal;
separating means for separating the residual component from the input voice signal after extraction of the sinusoidal wave components; and
adding means for adding the residual component to the output voice signal.

Neither Sethares nor Serra, alone or in combination with each other and/or the Examiner's Official Notice that implementation of a switching mechanism to output an original signal when an input signal cannot be analyzed is well known in the art, disclose, teach or suggest such an apparatus having (a) mixing means for mixing the plurality of the sinusoidal wave components having the modulated frequency value coordinates to synthesize the output voice signal having a pitch different from that of the input voice signal and influenced by that of the reference voice signal; (b) separating means for separating the residual component from the input voice signal after extraction of the sinusoidal wave components; and (c) adding means for adding the residual component to the output voice signal. Thus, applicants submit that new independent claim 49 distinguishes over Sethares and Serra, alone or in combination with the Examiner's Official Notice.

Applicants believe that the foregoing amendments place the application in condition for allowance, and a favorable action is respectfully requested. If for any reason the Examiner finds the application other than in condition for allowance, the Examiner is requested to call either of the undersigned attorneys at the Los Angeles telephone number (213) 488-7100 to discuss the steps necessary for placing the application in condition for allowance should the Examiner believe that such a telephone conference would advance prosecution of the application.

Respectfully submitted,

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